DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 5-6 and 9-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mizuhara (U.S. Patent 6,535,316 B1) in view of Miyamoto et al. (U.S. Patent 6,559,996 B1), Conradi (U.S. Patent Application Pub. 2003/0156774 A1) and Kikuchi et al. (U.S. Patent 6,850,713 B2).

Regarding claims 5 and 9, Mizuhara discloses in FIG. 3 an apparatus comprising an electrical RZ converter 302a and electrical RZ converter 302b, a Mach-Zehnder modulator 305. The difference between Mizuhara and the claimed invention is that Mizuhara does not specifically disclose a differential encoder. Miyamoto et al. discloses in FIG. 10 a differential encoder 72. One of ordinary skill in the art would have been motivated to combine the teaching of Miyamoto et al. with the apparatus of Mizuhara because the differential encoder produces pre-code electrical signal in complementary form and provides differentiated ternary level pulses having first level, second level and third level at a rising edge, a duration between a rising edge and a falling edge and a falling edge of said pre-coded signal, respectively, so that polarity of a pulse at said rising edge is opposite to that at said falling edge so that a RZ optical signal can be produced corresponding to the differentiated pulse. (See col. 4, lines 25-41 of Miyamoto). This approach lowers the spectrum density of the output optical signal and avoids Stimulated

Brillouin Scattering (see col. 10, lines 31-42). Thus it would have been obvious to one of ordinary skill in the art at the time the invention was made to include a differential encoder, as taught by Miyamoto et al., in the apparatus of Mizuhara.

The combination of Mizuhara and Miyamoto et al. still failed to teach using a clock signal in the RZ converter. Mizuhara refers in col. 3, lines 7 to prior art for the structure of a RZ converter. Conradi teaches in FIG. 5 a NRZ-to-RZ converter 600 comprising a AND gate and a clock signal. One of ordinary skill in the art would have been motivated to combine the teaching of Conradi with the modified apparatus of Mizuhara and Miyamoto et al. because an AND gate is commonly available and inexpensive. Thus it would have been obvious to one of ordinary skill in the art at the time the invention was made to use an AND gate and a clock signal for a RZ converter, as taught by Conradi, in the modified apparatus of Mizuhara and Miyamoto et al. because an AND gate is commonly available and inexpensive.

The Applicant argues that Conradi is operative only to synchronize one signal with a clock signal. However, Mizuhara teaches a RZ converter for each branch of the driving circuit for the dual-electrode modulator. It is inherent or obvious that the same clock signal would have been used for the two RZ converters. Furthermore, the Examiner cites Kikuchi et al. for teaching that the same clock signal would have been used for such application. Kikuchi et al. teach in FIG. 4 a driving circuit for a dual-electrode MZ modulator. FIG. 4 shows that the same clock signal is used for both RZ circuit.

Regarding claims 6 and 10, Miyamoto et al. teaches in FIG. 3 and FIG. 14 that the optical signal is modulated by a differential phase of $(0, \pi)$.

3. Claims 8 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mizuhara, Miyamoto et al., Conradi and Kikuchi et al. as applied to claims 5-6 and 9-10 above, and further in view of Vrazel et al. (U.S. Patent Application Pub. 2003/0198478 A1) and Ziemer et al. ("Principles of Communications", Third Edition by R. E. Ziemer et al., Houghton Mifflin, 1990, pp. 480-482).

Mizuhara, Miyamoto et al., Conradi and Kikuchi et al. have been discussed above in regard to claims 5-6 and 9-10. The difference between Mizuhara, Miyamoto et al., Conradi and Kikuchi et al. and the claimed invention is that Mizuhara, Miyamoto et al., Conradi and Kikuchi et al. do not teach the particular differential encoder. Instead, Miyamoto et al. teaches in FIG. 11 a slightly different encoder. First, the Examiner recognizes that the data signal would have been recovered at the receiving end using a corresponding decoder. As long as the corresponding decoder is used at the receiver, the particular differential encoder does affect the operation and performance of the system. Second, the particular encoder of the claimed invention is common used in the art. For example, Vrazel et al. teaches in FIG. 4A a DPSK precoder 405. The DSPK precoder of Vrazel et al. has an inverter at the input, which makes the DPSK precoder behave the same as the claimed differential encoder. Ziemer et al. teaches in FIG. 7.17 a DPSK modulator which includes an equivalence gate and a one-bit delay. Ziemer et al. teaches on page 481, second paragraph that the equivalence gate is the negation of an exclusive-OR gate. The truth table shown as Table 7.4 indicates that it operates the same as the claimed differential encoder. One of ordinary skill in the art would have combined the teaching of Vrazel et al. and Ziemer et al. with the modified apparatus of Mizuhara, Miyamoto et al., Conradi and Kikuchi et al. because the combination is a simple substitution of one known, equivalent element for another to obtain

predictable results. Thus it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the precoder of Vrazel et al. or Ziemer et al. in the modified apparatus of Mizuhara, Miyamoto et al., Conradi and Kikuchi et al.

Response to Arguments

4. Applicant's arguments filed 29 October 2009 have been fully considered but they are not persuasive.

The Applicant argues that Conradi is operative only to synchronize one signal with a clock signal. However, the rejection is based on the combination of Conradi, Mizuhara and Miyamoto et al. Mizuhara teaches a RZ converter for each branch of the driving circuit for the dual-electrode modulator. Since the two branch of the driving circuit are used for driving the same modulator, they must be synchronized.

The Applicant argues "Mizuhara's configuration specifically requires that the data signal be converted into separate (but identical) RZ (return-to-zero) signals before one of them is inverted. As such, by the time Mizuhara produces two signals which are inverted with respect to one another, they are already in return- to-zero format — there would be no reason to synchronize either of them with a clock signal." It is true that there is no synchronization step to the signal after they have been converted to RZ. However, the synchronization is done during the conversion from NRZ to RZ, as taught by Conradi.

The Applicant argues "Furthermore, Miyamoto does not teach or suggest converting differential signals into RZ signals in the electrical area; Miyamoto performs the NRZ-to-RZ conversion in the optical area. Accordingly, Mizuhara, Miyamoto, and Conradi, taken separately or in obvious combination, fail to teach or suggest generating an electric RZ differential signal

by synchronizing two differential signals, which are inverted versions of one another, with a clock signal, as presently claimed." The Examiner disagrees. Miyamoto uses bandpass filter (differentiation circuit) to convert NRZ to RZ and uses the pre-code circuit for shaping the spectrum density. The rejection relies on the teaching of Miyamoto on shaping the spectrum density.

Conclusion

5. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shi K. Li whose telephone number is 571 272-3031. The examiner can normally be reached on Monday-Friday (6:30 a.m. - 4:00 p.m.).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kenneth Vanderpuye can be reached on 571 272-3078. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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6 January 2010

/Shi K. Li/
Primary Examiner, Art Unit 2613